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GB 2100769 A GB 1216292 A WO 84/04126 A

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(54) Drain outlet

(57) A drain outlet comprises a bowl 2 for the collection of water, the bowl having a grill 4 and a set of vanes 28, 30 for preventing vortexing of the water in the bowl. A baffle 6 provided at above the outlet of the bowl prevents the ingress of air in with the water flow.

The drain outlet virtually eliminates air from water entering a full-flowing drainage system at the design flowrate and reduces the amount of air entering at flows below the design flowrate.

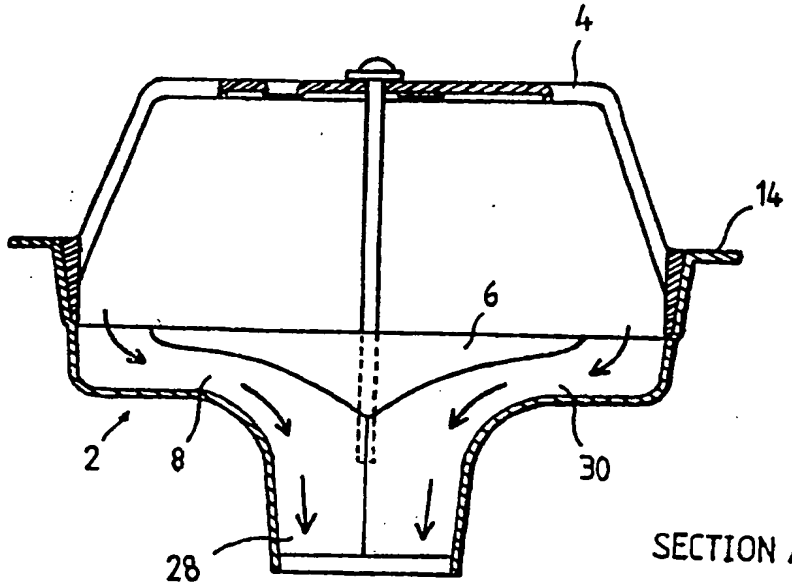

Fig. 5

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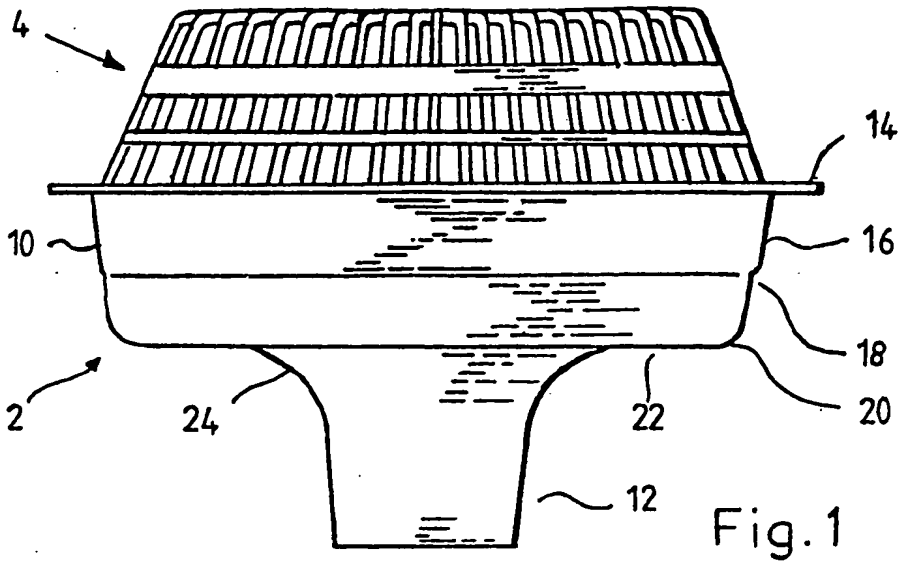


Fig. 1

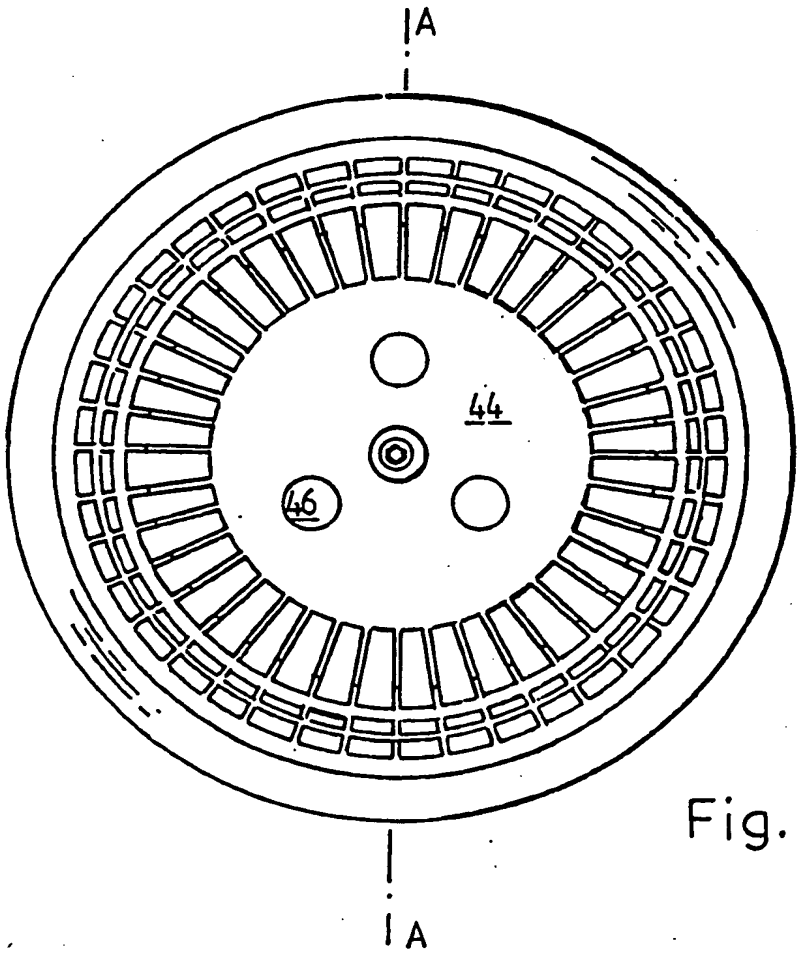


Fig. 2

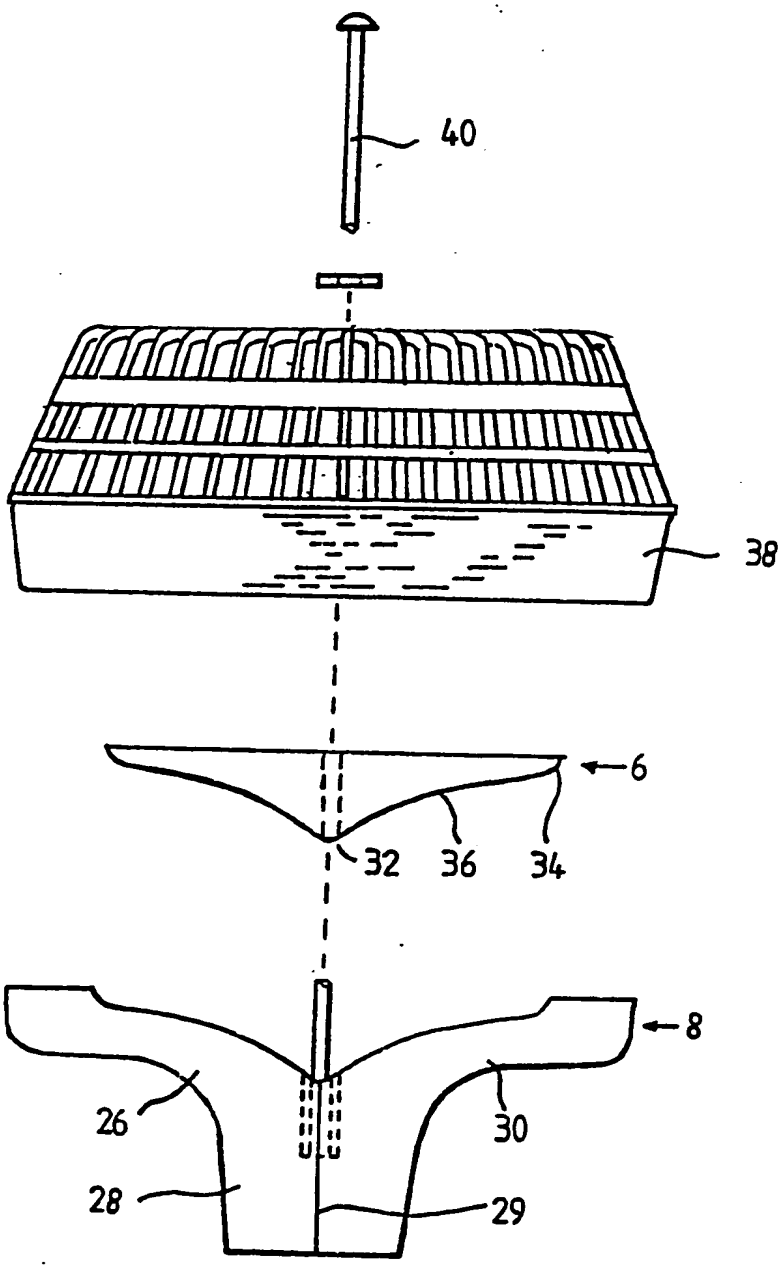


Fig.3

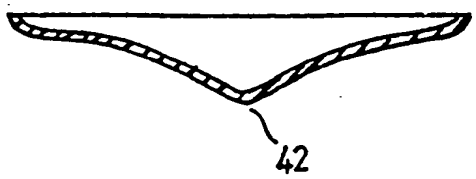
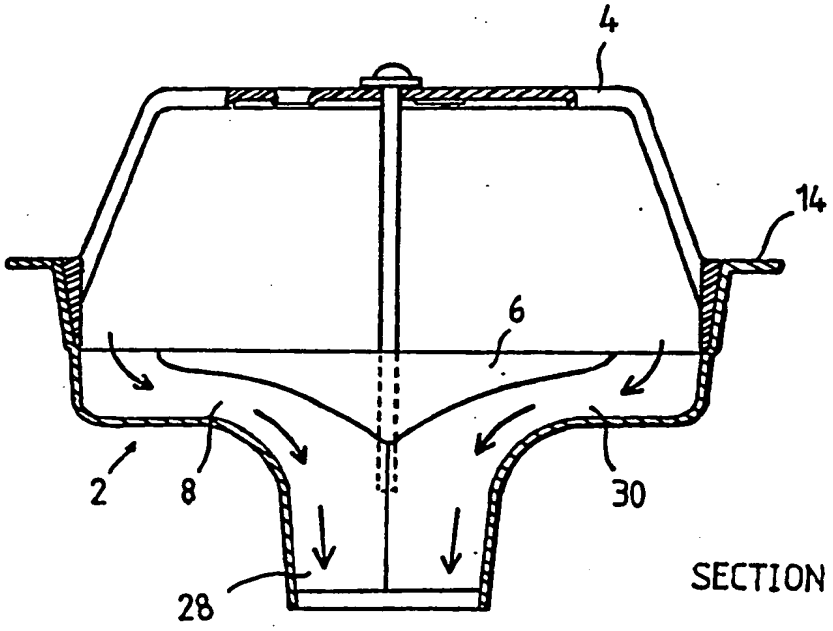


Fig. 4



SECTION A-A

Fig. 5

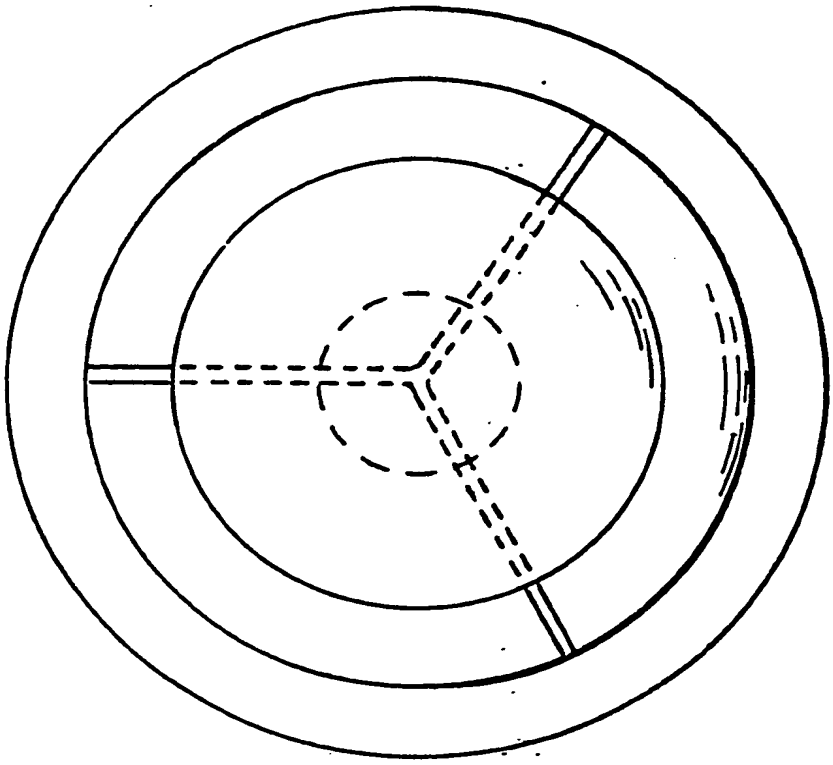


Fig.6

DRAIN OUTLET

This invention relates to a drain outlet suitable for use with drainage systems known as syphonic or full flowing systems. Syphonic systems find application in the context of roof drainage, though other applications are possible.

Syphonic drainage systems are used on buildings requiring water removal from their roofs during precipitation typically within gutters or from roof surfaces directly. Generally, rain water runs off the roofs and down a number of outlets provided on the roof. The outlets channel the water into the drainage system comprising one or more horizontal or near-horizontal pipes and a downpipe. Typically a plurality of outlets may feed a common horizontal pipe which extends within the building. A number of such horizontal pipes may feed a common downpipe. To enable maintenance of a suction effect throughout the system due to the falling mass of water in the downpipes drawing the water along the horizontal pipes and through the outlets, the diameters of these various pipes and the bends in the pipework, are carefully chosen. For example, the diameter of the horizontal pipe which is fed by a number of outlets, may change by a calculated amount at the position at which the tail-pipe from a further outlet connects to the horizontal pipe.

In designing syphonic systems, an aim is to reduce the amount of air entering the pipework with the water, thereby increasing the amount of water the pipework can take. One important way in which the air ingress may be reduced, is by preventing the formation of a vortex at the drain outlet into the pipework.

In an ideal syphonic drainage system, the outlet is designed such that the water leaving the drain outlet and entering the downstream pipework contains no air. In this ideal system, the water, as it flows within the pipework, exerts a negative pressure upstream of it, which draws further water along the pipework. Although the term "syphonic" is used in the art, and so is used in this specification, it may be more accurate to describe such systems as full-flowing drainage systems. In practice the ideal may never be achieved, but it is believed that the suction effect is found so long as the water/air mix exceeds about 60/40. In contrast, in conventional drainage systems which rely purely on gravity, the typical water/air mix would be between 20/80 and 30/70.

The present invention relates to a novel type of drain outlet suitable for use with the so-called syphonic drainage systems, which is of simple form but which tests have shown to be particularly efficient.

In accordance with the present invention there is provided a drain outlet comprising a drainage bowl which has an upper portion of relatively large cross-section and which is upwardly open to receive a liquid, and a lower outlet portion of relatively small cross-section; and means located within the bowl for substantially preventing the vortexing of liquid within the bowl, the means comprising one or more outwardly extending divider limbs dividing at least a lower region of the upper portion of the bowl, and/or the outlet portion, into a plurality of distinct flow passages; and a baffle component above those divider limbs.

This may have an advantage that the liquid cannot circulate around the bowl in a circumferential direction

to form a vortex, and may reduce turbulence and ingress of air which is associated with the vortex.

Preferably said vortex prevention means is so arranged as to substantially prevent the vortexing of liquid both in at least the lower region of the upper portion and in the outlet portion. Promoting a non-turbulent flow early on in a syphonic drain system, ie. in the drainage bowl, increases the syphonic effect in the drainage system.

Preferably, said divider limbs extend radially outwards from a central axis of the drainage bowl, and are arranged substantially in a vertical plane. Preferably, the divider limbs comprise walls. Preferably, the lower edges of said limbs conform to the inner surface of the bowl or at least to the lower region of the inner surface.

By providing outwardly extending upright limbs, the flow of liquid is directed radially, or nearly so, with respect to the bowl.

Suitably, said limbs extend from a lowermost position within the outlet portion, preferably substantially corresponding to the lowermost position of the outlet portion. Preferably, the limbs diverge in an upward and outward direction, and extend to an uppermost position within the upper portion of the bowl, preferably substantially corresponding to an intermediate height within the upper portion of the bowl. Preferably the limbs extend upwardly and outwardly to the periphery of the upper portion of the bowl.

Preferably there are provided means for preventing air entrainment into the liquid. Preferably the means for preventing air entrainment comprises a baffle plate located above the outlet portion in spaced relation thereto.

Preferably the baffle plate is located within the bowl, at a position lower than an upper peripheral rim of the bowl.

The positioning of the baffle plate may reduce the flow of air into the outlet portion, whilst allowing optimum rate of liquid flow into the outlet portion. The lower portion of the bowl, and the baffle are deep enough to reduce air intake into the outlet portion when liquid flowrates are low and liquid levels in the gutter are low. In a syphonic drainage system, this encourages the pipes to fill with water containing a low proportion of air and encourages the syphonic action to initiate at lower flowrates than would otherwise occur.

Preferably said means for preventing vortexing is arranged to substantially prevent vortexing of the liquid at all positions within the bowl, beneath the baffle plate.

Preferably, limb(s) form a support which supports the baffle plate above the outlet portion.

Preferably, the support has a plurality of limbs extending outwardly from a node and arranged substantially in a vertical plane, between the inner surface of the bowl and the under surface of the baffle plate. Preferably, the upper edges of said limbs, or sections of the upper edges, conform to the under surface of the baffle plate.

Suitably the limbs thereby form a cradle for the baffle plate.

Preferably, the upper portion of the bowl is wider than the baffle plate, so that a space is defined between the periphery of the baffle plate and the upper portion of the bowl, for the passage of liquid. Preferably the outlet portion of the bowl is narrower than the baffle plate. Preferably the arrangement is such that liquid cannot flow from the upper portion of the bowl to the outlet portion by direct axial movement therebetween. Rather, liquid must pass through the annular space between the periphery of the baffle plate and the upper portion of the bowl, and then follow an inwardly directed flow pathway, leading into the outlet portion, where it once again flows axially. Preferably the cross-sectional area of this flow pathway, in a direction transverse to the direction of liquid flow, is at all positions greater than the cross-sectional area of the outlet portion.

Suitably, the baffle plate is formed with a central cusp facing the outlet, the region between the cusp and the periphery of the baffle plate being concave. Preferably the inner surface of the bowl which opposes the concave region of the baffle plate is convex.

Preferably, the upper portion of the bowl is circular in horizontal cross-section and tapers inwards slightly in a downward direction. Preferably, the outlet portion is circular in horizonal cross-section, and tapers inwards slightly towards its lower end. Between the outlet portion and the upper portion, there is preferably a substantially horizontal wall portion and the edge regions at which this horizontal wall portion joins the upper

portion and the outlet portion are regions of gentle curvature, so as not to disturb the flow of the liquid.

The bowl is suitably formed of spun or pressed metal, or of vacuum moulded plastics material.

Preferably, the drain outlet further comprises a cover grille. Preferably, the grille is engageable with the bowl. Thus, the grille may have a lower, downwardly tapering depending skirt which engages within a flared portion of the bowl. One or other or both of the skirt and the flared portion of the bowl may be roughened to improve the grip therebetween.

Conveniently, the grille, the baffle plate and the support may form a unit, removably engageable with the bowl.

According to another aspect of the present invention, there is provided an outlet for a roof drainage configuration comprising a bowl having an upper rim, for fitting to a substantially horizontal gutter or directly to the roof such that water may flow over the rim into the bowl, the bowl having a sump portion for the collection of water, and an outlet portion through which the water is drained from the sump, the sump and outlet portion having smoothly curving contours to encourage smooth acceleration of water out of the bowl in a direction radially towards a central axis of the bowl;

a baffle member positioned in the bowl between the outlet of the bowl and the peripheral upper rim, for inhibiting flow of air directly into the outlet portion of the bowl in a direction axially of the bowl; and

a plurality of limbs each extending substantially radially between the central axis of the bowl and the sump portion, for inhibiting movement of the water in the sump in a direction circumferentially of the sump.

The above combination of features may advantageously provide smooth acceleration of water in the bowl, reducing turbulence in the flow of water, and reducing vortexing of the water and reducing the amount of air entrained with the water.

When incorporated into a syphonic drainage system, it has been experimentally observed that a drain outlet according to the above aspects enables a syphonic action in the drainage system to occur with lower rates of incoming liquid flow than would be present if other prior art designs of drain outlet were used in the same syphonic drainage system. Where a syphonic drainage system is designed such that syphonic action appears at a specified water flowrate (the "Design Flowrate"), using prior art drain outlets, it has been found experimentally, that use of a drain outlet according to the present invention, when substituted for the prior art drain outlets in the same drainage system, gives rise to syphonic action at lower flowrates than the design flowrate, and when relatively low incoming levels of water are present.

The invention will now be further described, by way of example, with reference to the accompanying drawings in which:

Fig. 1 shows a drain outlet in side elevation;

Fig. 2 shows the drain outlet of Fig. 1 in plan view;

Fig. 3 shows, in an exploded side elevation, a cover grille, baffle plate and support used in the drain outlet of Figs. 1 and 2;

Fig. 4 shows the baffle plate in vertical cross-section;

Fig. 5 shows the drain outlet of Fig. 1 in a partial cross-section along the line A-A shown in Fig. 2; and

Fig. 6 shows the drain outlet in the plan view of Fig. 2, but with the cover grille removed.

The drain outlet shown in the drawings has a drainage bowl 2, an upper cover grille 4 and, located between the bowl 2 and the cover grille 4, a flow control means comprising a baffle plate 6 and a support 8.

The bowl 2 comprises an upper portion 10 of relatively large cross-section and a lower, central, outlet portion 12 of relatively small cross-section. The upper portion 10 has an upper annular horizontal rim 14. Extending downwardly from the inner periphery of the rim 14 is a side wall 16 which is circular in cross-section and which tapers slightly in a downward direction. At an intermediate position of the side wall, there is an inward step 18. At the lower end of the side wall 16 is a corner region 20 of gentle curvature, leading to a horizontal wall portion 22. This leads in turn, via a corner region 24 of still gentler curvature, to the outlet portion 12. The outlet portion 12 tapers slightly in a downward direction.

The support 8 comprises three vane-like limbs 26, arranged at 120° to each other, each being of a rigid thin-

walled material, each in a vertical plane. The lower portions 28 of the limbs 26 are joined to each other at a node 29 and the upper portions 30 of the limbs diverge from each other. As shown in Fig. 5 the lower portions 28 locate snugly within the outlet portion 12 of the bowl, the lower edges of the limbs conforming to the inner surface of the bowl. The vane-like limbs extend radially outwardly from a central axis of the bowl, and divide the lower region of the bowl and the outlet portion into three distinct flow passages.

The upper edges of the divergent portions 30 of the limbs are shaped to serve as a cradle to receive the baffle plate 6. The baffle plate 6 is a disc-like member formed with a cusp, with the apex 32 of the cusp facing downwards. Thus, the baffle plate 6 has, between its central cusp 32 and a small convex peripheral region 34, a generally concave region 36. The baffle plate is located in the bowl at a position lower than the upper horizontal rim 14 of the bowl.

As will be seen in Fig. 5, when the baffle plate 6 is engaged upon the support 8, there is defined, between the baffle plate and the lower region of the bowl, three substantially independent flow passages. The limbs 26 act as a physical barrier preventing water from vortexing in the entire region between the top of the baffle plate 6 and the bottom of the outlet portion 12.

As the baffle plate is set within the bowl at a position lower than the upper rim 14 of the bowl, the influx of air into the outlet portion from vertically above the outlet portion is restricted, as the baffle plate restricts the flow of air into the outl t. The position of the baffle plate in the bowl is selected so as

to reduce air flow into the outlet, whilst all wing th optimum rate of flow of water through the flow passages. This helps to prevent local vortexes within each of the independent flow passages.

The outlet portion is of considerably narrower cross-section than the transverse cross-section of the flow pathway defined by the three passages, mentioned above.

The cover grille 4 has an array of vertical and circumferential ribs between which water may flow. It has a downwardly depending skirt 38, which has a slight taper in the downward direction. The skirt 38 is roughened for frictional purposes. The skirt is for engagement with the flared portion, above the step 18, of the upper region of the bowl member, with the periphery of the skirt resting on the step 18.

In this embodiment, the cover grille, baffle plate and support are secured together by means of a bolt 40, but other methods of securing are equally possible. The head of the bolt presses a washer against the cover grille 38 and the shank of the bolt passes through an aperture 42 at the cusp 32 of the baffle plate, and is screwed into a tapered hole within the support 8. In other embodiments, these three parts need not be secured together.

As shown in Fig. 2, the cover grille has a top wall with a central wall portion 44 not formed with ribs and apertures (since these would not serve any function, in that location). Instead, the central wall portion 44 is formed with finger holes 46 to aid removal.

In this embodiment the bowl is of a plastics material, and vacuum moulded, or of a metallic material,

and formed by spinning or pressing. The grille is of a plastics material and injection moulded. The baffle plate is of a plastics material, and injection moulded. The support may be of a plastics material, and injection moulded or formed by welding together the three limbs.

In use, the drain outlet is located on a roof, with the rim 14 located externally, against a substantially horizontal panel within a gutter or directly to a roof and with the bowl extending downwardly. To prevent condensation forming on the under surface of the bowl, a foam jacket (not shown) conforming to the shape of the bowl, may be located on the under surface of the bowl. The outlet portion 28 is connected to a tail-pipe (not shown). In accordance with standard practice the tail-pipe may be connected to a horizontal or near horizontal pipe. A number of tail-pipes fed by respective outlets may be fed to the horizontal or near horizontal pipe, whose diameter may change as further tailpipes are fed to it. The pipe diameters are carefully calculated so that water flow by a suction mechanism is likely to be achieved, even on precipitation below the design flowrate.

When precipitation is moderate, flow of water into the outlet may still be rapid because of the very large roof area which feeds it. Water will flow along the gutter or roof surface, then over the rim 14 and into the bowl. It will pass along the flow passages defined between the baffle plate 6 and the inner facing surface of the bowl. Initially it will flow substantially vertically, and it will then be directed inwardly, to follow a transverse flowpath before entering the outlet portion, where it once again flows substantially vertically.

In practice the outlet portion will fill with water under quite low rates of precipitation. It will be apparent that the nature of the limbs is such as to prevent the vortexing of water both in the region between the baffle plate and the bowl and within the outlet portion. Because of the lack of vortexing, air ingress is minimised and it is believed that the water flowing within the outlet portion draws further water into the outlet portion by a suction effect.

When there is heavy precipitation, water may rise within the gutter or on the roof surface, to be above the rim 14. Once this happens, it appears that the drain outlet works still more efficiently. Air ingress appears to be minimised further. This is thought to be because the water no longer falls into the bowl over the inner edge of the rim 14. Thus, not only does the increased head of water increase flowrate, but the water appears to contain less air, so enabling faster water removal. The suction effect then promotes the rapid drawing of water from the gutter or roof surface, into the outlet.

CLAIMS

1. A drain outlet comprising:

a drainage bowl which has an upper portion of relatively large cross-section and which is upwardly open to receive a liquid, and a lower outlet portion of relatively small cross-section; and

means located within the bowl for substantially preventing the vortexing of liquid within the bowl, said means comprising one or more outwardly extending divider limbs, dividing at least a lower region of the upper portion of the bowl, and/or the outlet portion into a plurality of distinct flow passages.

2. A drain outlet according to claim 1, wherein said means is so arranged as to substantially prevent the vortexing of liquid both in at least a lower region of the upper portion and in the outlet portion.

3. A drain outlet according to claim 1 or 2 wherein said divider limbs extend radially outwards, from a central axis of the drainage bowl.

4. A drain outlet according to claim 1 or 2, wherein said limbs comprise divider walls arranged substantially in a vertical plane.

5. A drain outlet according to any one of claims 1 to 4, wherein the lower edges of said limbs conform to the inner surface of the bowl or at least to the lower region of the inner surface.

6. A drain outlet according to any one of claims 1 to 5, wherein said limbs extend from a lowermost position within the outlet portion, substantially corresponding to a lowermost position of the outlet portion.

7. A drain outlet according to any one of claims 1 to 6, in which the limbs diverge in an upward and outward direction and extend to an uppermost position within the upper portion of the bowl, corresponding to an intermediate height within the upper portion of the bowl.

8. A drain outlet according to any one of claims 1 to 7, in which the limbs extend upwardly and outwardly to the periphery of the upper portion of the bowl.

9. A drain outlet according to any one of claims 1 to 8, having means for preventing air entrainment into the liquid.

10. A drain outlet according to claim 9, wherein the means for preventing air entrainment comprises a baffle plate located above the outlet portion in spaced relation thereto.

11. A drain outlet according to claim 10, wherein the baffle plate is located in the bowl at a position lower than an upper peripheral rim of the bowl.

12. A drain outlet according to claim 10 or 11, wherein said means for preventing vortexing is arranged to substantially prevent vortexing of the liquid at all positions within the bowl, beneath the baffle plate.

13. A drain outlet according to any one of claims 10 to 12, wherein said limb(s) comprise(s) a support which supports the baffle plate above the outlet portion.

14. A drain outlet according to claim 13 wherein the support has a plurality of limbs extending outwardly from a node and arranged substantially in a vertical plane between the inner surface of the bowl and the under surface of the baffle plate.

15. A drain outlet according to claim 14, in which the upper edges of said limbs or sections of the upper edges, conform to the under surface of the baffle plate, thereby forming a cradle for the baffle plate.

16. A drain outlet according to any one of claims 10 to 15, wherein the upper portion of the bowl is wider than the baffle plate, so that a space is defined between the periphery of the baffle plate and the upper portion of the bowl for the passage of liquid.

17. A drain outlet according to any one of claims 10 to 14, in which the outlet portion of the bowl is narrower than the baffle plate, such that liquid cannot flow from the upper portion of the bowl to the outlet portion by direct axial movement therebetween.

18. A drain outlet as appendant to claim 10, in which the arrangement is such that liquid must pass through the annular space between the periphery of the baffle plate and the upper portion of the bowl and then follow an inwardly directed flow pathway leading into the outlet portion, where it once again flows axially.

19. A drain outlet according to claim 18, in which the cross-sectional area of the flow pathway in a direction transverse to the direction of liquid flow is at all positions greater than the cross-sectional area of the outlet portion.

20. A drain outlet according to any one of claims 10 to 19, wherein the baffle plate is formed with a central cusp facing the outlet, a region between the cusp and the periphery of the baffle plate being concave.

21. A drain outlet according to claim 20, wherein an inner surface of the bowl which opposes the concave region of the baffle plate is convex.

22. A drain outlet according to any one of claims 1 to 21, in which the upper portion of the bowl is circular in horizontal cross-section and tapers inwards in a downward direction, the outlet portion is circular in horizontal cross-section and tapers inwards to its lower end, and between the outlet portion and the upper portion, there is provided a substantially horizontal wall portion and joining this horizontal wall portion to the upper portion and the outlet portion are regions of gentle curvature, arranged so as not to disturb the flow of liquid.

23. A drain outlet according to any one of claims 1 to 22, in which the bowl is of metal and formed by a spinning process.

24. A drain outlet according to any of claims 1 to 22, in which the bowl is of metal and formed by a pressing process.

25. A drain outlet according to any one of claims 1 to 24, further comprising a cover grill, the grill being engageable with the bowl, and the grill having a lower downwardly inwardly tapering depending skirt which engages within a flared portion of the bowl.

26. A drain outlet according to claim 25, in which the skirt and or the flared portion of the bowl are roughened to improve the grip therebetween.

27. A drain outlet according tc any one of claims 21 to 26 as appendant on claim 10, in which the grill, the baffle plate, and the support forms a unit removably engageable with the bowl.

28. An outlet for a roof drainage configuration, the outlet comprising:

a bowl having an upper rim, for fitting to a horizontal gutter of the roof, such that water may flow over the rim into the bowl, the bowl having a sump portion for the collection of water, and an outlet portion through which the water is drained from the sump, the sump and outlet portion having smoothly curving contours to encourage smooth acceleration of water out of the bowl, in a direction radially towards a central axis of the bowl;

a baffle member positioned in the bowl between the outlet of the bowl and the peripheral upper rim, for inhibiting flow of air directly into the outlet portion of the bowl in a direction axially of the bowl; and

a plurality of limbs each extending substantially radially between the central axis of the bowl and the sump

portion, for inhibiting movement of the water in the sump in a direction circumferentially of the sump.

29. A drain outlet substantially as herein described with reference to the accompanying drawings.

Patents Act 1977
Examiner's report t the Comptroller under Section 17
(The Search report)

Application number
GB 9315878.0

Relevant Technical Fields

(i) UK Cl (Ed.L) E1C

(ii) Int Cl (Ed.5) E03F; E04D

Search Examiner
D HAWORTH

Date of completion of Search
28 OCTOBER 1993

Databases (see below)
(i) UK Patent Office collections of GB, EP, WO and US patent specifications.

(ii)

Documents considered relevant following a search in respect of Claims :-
1-29

Categories of documents

X: Document indicating lack of novelty or of inventive step.

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A: Document indicating technological background and/or state of the art.

P: Document published on or after the declared priority date but before the filing date of the present application.

E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

&: Member of the same patent family; corresponding document.

Category	Identity of document and relevant passages		Relevant to claim(s)
A	GB 2100769 A	(KONTEKLA OY)	
A	WO 84/04126 A	(AEROMATOR)	
A	GB 1216292 A	(KONTEKLA OY)	

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